

Enhancing Teachers' Competence in the Use of Instructional Materials in Electronics Education in Senior Secondary Schools in Nigeria

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Abstract

Technology is the touchstone of development and the field of electronics is considered important in the fast developing society. Through the teaching of electronics in secondary schools, students learn basic skills needed to manufacture, operate, maintain, install and repair electrical and electronic equipment. It therefore means that the transfer of these knowledge, skills and attitudes require instructional resources for effective and efficient skill acquisition. This paper therefore focused on enhancing the competence of electronics teachers in the utilization of instructional resources for effective electronics subject delivery which has been reported as lacking among secondary school technology teachers in Nigeria. Problems associated with the effective use of these instructional materials in secondary schools such as poor teachers' professional knowledge and insufficient awareness of types of instructional materials for use in teaching different electronics contents, were highlighted. Also, the electronics teachers developing positive attitude towards the use of instructional materials; maintaining appropriateness of the materials to instructional objectives and multidimensional presentations of these materials among others, were strategies postulated for enhancing teachers' competence in instructional material utilization.

Keywords: Competence, electronics, instructional materials, teachers, utilization.

1. Introduction

Technology has been described as the bedrock for global development, and many nations of the world have keyed into it (Okonji, 2014). Essentially, technology is the primary engine of economic growth. It plays a fundamental role in wealth creation, improvement of the quality of life and real economic growth and transformation in any society. It provides the key to unlocking any country's potential in terms of decreasing overhead costs associated with outsourcing and creating employment opportunities (Egboga, 2012). The impact of technology is felt in every sphere of human life so much that it is intricately linked with all aspects of nation's development.

Nigeria as a nation has seen the increasing importance of global technology development. In recent times most of its policies are tilted towards technology as the main driver of economic development (Okonji, 2014). In recognition of technology as the touchstone of development, Nigeria in its national school curriculum included the teaching of technology as a field of specialization at secondary education level. Subjects under this field include Technical Drawing, Metal Work, Basic Electricity, Electronics, Auto Mechanics, Building Construction, Wood Work, Home Management, Foods and Nut, and Clothing and Textile (WAEC, 2014).

Electronics, perhaps more than any other field of technology, has enjoyed an explosive development in this century (Horowitz & Hill, 1995). In this fast developing society, electronics has come to stay as the most important branch of engineering. Electronics devices are being used in almost all industries for quality control and automation and they are fast replacing the present vast army of workers engaged in processing and assembling in the factories (Mehta & Mehta, 2008). Development in the field of electronics has constituted one of the greatest stories of this century.

The objectives of studying electronics in secondary schools in Nigeria as contained in WAEC syllabus include among others, to equip candidates with broad understanding of the technology of manufacturing, maintenance and repair of domestic and industrial equipment. It is also intended to offer candidates sufficient knowledge and skills to form valuable foundation for electronic-related vocation or pursue further educational qualifications (WAEC, 2014). Technology is achieved through a combination of knowledge, methods, tools and skills. Thus, electronics as a technology subject is activity or practical-oriented and the appropriate methods of teaching it is resource base. This suggests that the mastery of electronics skills cannot be fully achieved without the effective use of practical instructional materials.

Instructional resources are educational inputs that are vital to the teaching of any subject in the school curriculum. They are materials which the teacher uses in supplementing his teachings (Adeniyi, 2001). Teachers are considered as the major implementing factors of effective resource utilizations in any teaching-learning

process. The term utilization refers to the usage degree of a given material in the execution of a given task (Uzuegbu, Mbadiwe & Anulobi, 2013). It involves creation of value in things (Asogwa, Onu & Egbo, 2013). Utilization to a large extent judges the value of instructional materials by the degree in which it singly or collectively satisfies the derived instructional needs. In the context of this paper, utilization refers to the extent to which an instructional material in electronics instruction is put into use by teachers of electronics in senior secondary schools.

Instructional materials are not ends in themselves but means of attaining specific instructional functions. The ability of the teacher to effectively utilize the available instructional materials optimizes the attainments of instructional situation; this varies with the level of utilization. A situation where an electronics teacher pays “lip service” to activity-oriented instructional methods and resources that could enhance creative thinking in the learners negates the objectives of electronics education at the secondary school. The need to fashion out ways of enhancing the effective use of instructional materials by teachers in order to provide students with practical experiences in electronics instruction is the thrust of this paper. Thus, briefly discussed are as follows:

The concept of teachers' competence

The definition and conceptualization of instructional materials and utilization,

Importance of effective utilization of instructional materials in electronics education,

Problems associated with the use of instructional materials.

Strategies for enhancing teachers' competence in the use of instructional materials

2. The Concept of Teachers' Competence

There are various approaches and definitions of the concept of competence. Eraut (as cited in Orji & Abolarin, 2012) defined competence as the ability to perform the task and roles required to the expected standards. According to Weinert (2001) competencies are the positive combinations of knowledge, ability and willingness in the ability of the individual to cope successfully and responsibly with changing situation. Similarly, Orji and Abolarin (2012) refer to competence as the effectiveness or ability of anyone concerned to apply the acquired knowledge and skill to achieve desired results.

These definitions express competence as changing over time, experience and setting. Thus, competence as a concept cannot be communicated but developed. In this regard, Urevbu (2006) views teacher competencies as knowledge, skills and values which a teacher possess. They are tools of teaching and only teachers who possess all the skills, knowledge and values needed to function effectively in the classroom situation are competent to teach in the situation. Therefore teacher competence in instruction delivery is key necessary input in realizing the objectives of electronics education.

3. The Definition and Conceptualization of Instructional Materials and Utilization

The concept of instructional materials also referred to as instructional aids, have gone beyond simple aids, instructional technology, and media to communication and educational technology. According to Olawale (2013) instructional materials include materials used to facilitate learning for better results. In the same vein, Uzuegbu, Mbadiwe & Anulobi (2013) refer to instructional materials as any device used to assist the instructor in the preparation of a lesson, teaching of the lesson and facilitate students' learning of the subject matter. They include those objects that are commercially acquired or improvised by the teacher to make conceptual abstraction more concrete and practical to the learner (Iwu, Ijioma, Onoja & Nzewuihe, 2011). They are relevant materials utilized by the teacher during instructional proceeds for the purpose of making the contents of the instructions more practical and less vague. Instructional materials are also described as concrete or physical object which provide sound, visual or both to the sense organs during teaching (Agina-Obu, 2005). Thus, instructional materials could be regarded as the information dissemination devices used in the classroom for easy transfer of learning. They provide first-hand experience where possible or of vicarious one where only that is feasible.

There are different instructional materials available to be used in teaching electronics subject effectively, but not all topics require the same type and quality of material. Hence, instructional materials are classified in different ways. The criteria for classifying these materials include the degree of expertise / technical skills needed for production, nature of the materials, physiological parameter or sensory modality, the place the material is produced and miscellaneous characteristics. Based on the foregoing, instructional materials are generally classified into three forms: Audio or aural instructional materials, visual instructional materials and audio-visual materials (Oladejo, Olosunde, Ojebisi & Isola, 2011; Odianwu & Azubike, cited in Olawale, 2013). Also, most educators equally agree that printed materials is the fourth major category of instructional materials (Adekeye, cited in Iwu, Ijioma, Onoja & Nzewuihe, 2011).

Audio or aural instructional materials are those devices that make use of the sense of hearing only, such as radio, audio tape recording and television; while visual instructional materials refer to the devices that appeal to the sense of sight only, such as the chalkboard, chart, slide, and filmstrip. On the other hand, audio-

visual materials are combination of devices which appeal to the sense of both hearing and seeing, like television, motion picture and computer. Printed materials include textual materials such as magazines, newspapers, journals as well as programmed learning materials that students read and memorize for understanding of electronics principles.

Another common classification of instructional materials is into projected or electronic materials; non-projected materials and manipulative materials (Iwu, Ijioma, Onoja & Nzewuihe, 2011; Ogbondah, 2008). Projected and electronic materials are forms of instructional materials that contain bits of information that are projected on screen. They are basically devices that make use of electricity to produce clear images on screen and give illusion to reality in teaching learning process of electronics subject. Types of projected and electronics aids commonly used in electronics instruction include radio, slide projectors, overhead projectors, tape recorders / recording, episcopes video cassette / video disc machine and computer instructional system. Non-projected material refers to instructional materials containing bits of information that do not require any form of projection before they can be utilized. They include textual (printed) and non-textual materials such as charts, chalkboards, films, audio and video tapes. Others are models, specimens or real object. Manipulative materials are instructional materials which the learner handles skillfully and expertly to bring about the desired behavioural changes. They express the channel through which the required learning takes place hence cutting across all aspects of skill development and mastering learning. They include real object or simulators in form of machine operations being demonstrated, learnt and observed through instructional process. Instructional resources of any form which are educational inputs are of vital importance to the teaching of any subject in the school curriculum

4. Importance of Effective Utilization of Instructional Materials in Electronics Instruction

Several people have written on the importance of instructional materials to teaching. Agbulu and Wever (2011) posited that instructional materials are important because they are used for the transference of information from one individual to another, help the teacher in extending his learner's horizon of experience, stimulate learners' interest and help both teachers and students to overcome physical limitations during the presentation of subject matter, among others. Also, most educators generally and equally agree that the creative use of variety of instructional materials will increase the probability that student would learn more, retain better and bring about the skills they are expected to perform (Adewoyin, cited in Olawale, 2013).

Effective instruction in electronics subject cannot be fully accomplished without the use of instructional materials. Their use promotes closer and effective communication between the teacher and the learners. Specifically, the use of instructional materials is relevant to the electronics teacher in the following areas;

- It provides the electronics teacher with interesting and competing platforms for conveying information since they motivate learners to learn more and more.
- Their use helps the teacher to overcome physical difficulties that could have hindered his effective presentation of a given topic.
- They are used to explain points, create reality and supply events, encourage active participation.
- Their use saves the teachers' time.
- They provide meaningful and useful sources of information to teachers

On the other hand, adequate and appropriate utilization of materials by an electronics teacher enable electronics students to:

- Develop positive attitude and healthy self concept because successes in carrying out the activities make electronics students believe they can do it.
- Enjoy and appreciate their subjects of study.
- Develop understanding and judgment.
- Develop functional knowledge and manipulative skill
- Visualize or experience something.
- Facilitate different learning styles.
- Stimulate learners' interest and curiosity.
- Develop continuity of reasoning and coherence of thoughts.
- Reduce verbalism or repetition of words.
- Possess opportunities for private study.

5. Problems Associated with the Use of Instructional Materials

The rapid growth of electronic technology offers a formidable challenge to the electronics teacher, who may be almost paralyzed by the mass of details. However the use of practical instructional materials can simplify the learning process to a great extent. In order to ensure an effective teaching learning process, it is important for the teacher to be thoroughly acquainted with the teaching resources and services available to him. Instructional materials for electricity and electronics subjects' instruction at secondary schools are not adequately available;

more so, how to make the best instructional use of those available with the modern innovation are grossly lacking and faced with a lot of problems in its use by electronics teachers (Aneale, 2000; 2004; Bello & Shuaibu, 2013; Medugu, 2009; Umunadi, 2009; Taale & Mustapha, 2014). Some of the revealing problems as highlighted by these researchers include:

- Poor teachers' professional knowledge and technical know-how to teach practical skill content areas of electronics.
- Low teacher competence in the area of effective instructional resource utilization.
- Failure to appreciate the importance of using instructional materials in promoting and understanding of electronics principles.
- Insufficient awareness of types of instructional materials for use in teaching different electronics contents.
- Insufficient time allocation to accommodate effective instructional materials utilization in electronics instruction.
- Lack of finance to acquire or improvise needed instructional materials. .
- Environmental factors such as little or non-availability of equipped library, laboratories, workshops, water supply, electricity and personnel also affects effective utilization of instructional materials.
- Poor maintenance culture of existing instructional materials especially projected and manipulative types
- Lack of opportunities for in-service training/refresher course for serving electronics teachers to update their knowledge periodically in the light of new research findings and resource development.

6. Strategies for Enhancing Teachers' Competence in the Use of Instructional Materials

Instructional materials are derived from various sources; they can be purchased, locally made, imported or even improvised when necessary for effective instructional delivery (Iwu, Ijioma, Onoja & Nzewuihe, 2011). The professional electronics teacher needs to note that every instructional material has its definite unique strength in teaching-learning situation. Furthermore, better teaching and faster learning of electronics principles can be facilitated by careful selection, development and skillful utilization of appropriate instructional materials by the competent teachers. Based on the foregoing, the following strategies are suggested to enhance the electronics teachers' competence in the selection, development and utilization of instructional materials for effective electronics instruction delivery:

- Develop positive attitude towards the development and use of instructional materials in electronics instructional delivery in schools.
- The instructional objectives, content learning activities and evaluation instruments should be taken into consideration by the teacher in the selection, development and utilization of instructional materials. In other words, maintain appropriateness of the materials to instructional objectives.
- The electronics content for which the instructional materials is being selected, where in doubt, the electronics teacher should consult. The aphorism that two good heads are better than one good head becomes more relevant in the field of education particularly in teaching.
- Reflect individual differences of learners' characteristics in the use of instructional materials. This is because the age, level, interest, socio-economic background, learning style, physical skills of the learner often varies and hence materials to be selected, developed and used should relate to the individual differences of the learner. This is necessary because learners as human beings learn through various senses and hence the resources/materials that appeal to more than one sense should essentially be utilized.
- Economic factor should be considered in selecting instructional materials for use in electronics lesson delivery. Finance is one of the major problems facing schools. Therefore, the teacher must consider the cost of financial implications of the resource to be selected for classroom utilization. There are a lot of resources in the local neighborhood which innovative teacher can exploit for the benefit of their students.
- Before selecting or developing any resource, consideration should be given on the number of teaching/learning situations to which the resource can be applied. This is because it is more economical to buy or develop a material which has dual usage than one that can be applied in a single learning situation. Therefore, acquisition of instructional materials having a wide range of practicability is essential.
- The teachers should realize the need for improvisation if the cost of purchasing is high. Such improvisation is a way of increasing inquiry, curiosity, creativity and productive application of intellect.
- Development or improvisation of instructional materials could also be done concurrently with the students such as projects or group assignments in designing and manufacturing some gadgets of learning. This also promotes creativity among students.

- Some dynamic variables such as the size of the target audience, the classroom social climate, sitting, viewing and listening arrangement, available time space, the desired level of learners' response and participation are to be seriously considered in the decision, selection and development of instructional materials for use in electronics lesson delivery.
- Once an instructional material has been selected and developed, the teacher should preview the material before they are brought to the class to determine the operational state of the intended material, especially the manipulative aids, before the actual presentation.
- Multidimensional presentations should be encouraged as the use of variety of the materials will increase curiosity and may appeal to more than one sense of the learner.
- At the end presentation with the instructional materials, outcomes should be measured in order to evaluate the effectiveness of instructional delivery.

7. Conclusion

The delivery of quality instruction in the classroom in any education system depends largely on the quality and competence of the teachers. This is because the teachers are expected to perform the important function of guiding, directing, evaluating, imparting, asking and answering questions among others for maximum benefits of the learners. The implication is that the teacher is the stronghold on which the business of educators rests upon the world over. The competent electronics teacher who is curious of effective instructional delivery sees instructional materials not as a gadgets like textbooks, chalks, chalkboard but as every necessary resources and objects which the teacher develops and improvises for use in the process of instructional delivery to concretize his lesson for effective and more reliable understanding by the learner about skills and knowledge of electronics lesson.

Based on the conclusion of the paper, the researchers recommended the following:

1. Secondary school administrators should allot enough funds for the instructional materials used in teaching electronics and other practical-oriented subjects.
2. Administrators should prioritize the purchase of instructional materials for instructional purposes of the student and teaching staff members.
3. Workshops and seminars should be organized from time to time for electronics teachers where they would be taught not only how to produce instructional material but also how to use them effectively for the achievement of educational goals.
4. Teachers of electronics should be resourceful enough to procure instructional materials and that are lacking in the schools.
5. Teachers should check the instructional materials often to ensure that it is still working and in good running condition.
6. Resources centers should be established at strategic locations within an educational area and be well equipped with instructional materials from where teachers could loan from.

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